

Notice of Allowability

Application No.

10/736,666

Applicant(s)

FISCHER ET AL.

Examiner

Sylvia R. MacArthur

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the pre-appeal request mailed 10/23/2006.
2. ☒ The allowed claim(s) is/are 1-25.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

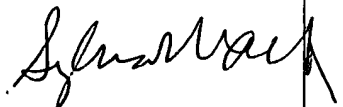
Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date 10/25/2005
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____



DETAILED ACTION

Election/Restrictions

1. Claims 1-22 and 25 are directed to an allowable product. Pursuant to the procedures set forth in MPEP § 821.04(B), claims 23 and 24, directed to the process of making or using an allowable product, previously withdrawn from consideration as a result of a restriction requirement, claims 23 and 24 are hereby rejoined and fully examined for patentability under 37 CFR 1.104.

Because all claims previously withdrawn from consideration under 37 CFR 1.142 have been rejoined, **the restriction requirement as set forth in the Office action mailed on 5/20/2005 is hereby withdrawn.** In view of the withdrawal of the restriction requirement as to the rejoined inventions, applicant(s) are advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Once the restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See *In re Ziegler*, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

LISTING OF CLAIMS:

1. (Currently Amended) A temperature-controlled hot edge ring assembly adapted to surround a semiconductor substrate support in a plasma reaction chamber, the assembly comprising:

a ~~conductive~~ lower ring made of an electrically conductive material;

a ceramic intermediate ring, the intermediate ring overlying the lower ring, the intermediate ring adapted to be attached via the lower ring to an RF electrode incorporated in the substrate support; and

an upper ring, the upper ring overlying the intermediate ring, wherein the upper ring has an upper surface exposed to an interior of ~~[[a]]~~ the plasma reaction chamber, wherein the lower ring is in direct contact with the RF electrode.

2. (Original) The assembly of claim 1, wherein the intermediate ring is made of aluminum oxide.

3. (Original) The assembly of claim 1, wherein the intermediate ring is made of quartz, silicon, silicon carbide or aluminum oxide.

4. (Currently Amended) The assembly of claim 1, wherein the ~~conductive~~ lower ring is made of aluminum or alloy thereof.

5. (Original) The assembly of claim 1, wherein the ~~conductive~~ lower ring is made of aluminum, aluminum alloy, brass, copper, copper alloy or stainless steel.

6. (Original) The assembly of claim 1, wherein a lower surface of the upper ring is bonded to an upper surface of the intermediate ring via a thermally conductive elastomer.
7. (Currently Amended) The assembly of claim 1, wherein the ~~conductive~~ lower ring has a plurality of holes configured to bolt the ~~conductive~~ lower ring to the RF electrode.
8. (Currently Amended) The assembly of claim 1, wherein the ~~conductive~~ lower ring and the intermediate ring have a plurality of holes configured to bolt the intermediate ring to the ~~conductive~~ lower ring.
9. (Currently Amended) The assembly of claim 1, wherein the ~~conductive~~ lower ring has a substantially L-shaped cross-section.
10. (Currently Amended) The assembly of claim 7, further comprising a first bolt having a tapered head at one end and a screw thread at the other end, the first bolt configured to bolt the ~~conductive~~ lower ring to the RF electrode.
11. (Currently Amended) The assembly of claim 8, further comprising a second bolt having a head at one end and a screw thread at the other end, the second bolt configured to bolt the intermediate ring to the ~~conductive~~ lower ring.
12. (Original) The assembly of claim 1, further comprising a conductive washer configured to receive a bolt having a head at one end and a screw thread at the other end, wherein the conductive washer is positioned between the upper ring and the intermediate ring.

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13. (Original) The assembly of claim 12, further comprising a plurality of holes in the upper ring, wherein the plurality of holes receive a cap, the cap having a vent hole configured to release pressure from within the edge ring assembly.

14. (Original) The assembly of claim 1, wherein the upper ring is made of silicon, carbon, graphite, or silicon carbide.

15. (Original) The assembly of claim 1, wherein the upper ring has a portion extending under a substrate when the substrate is located on the substrate support.

16. (Currently Amended) A plasma processing apparatus comprising:

a processing chamber adapted to process a semiconductor substrate;

a power source which energizes process gas in an interior of the processing chamber into a plasma state for processing [[a]] the substrate;

a substrate support which supports [[a]] the substrate within the interior of the processing chamber, the substrate support including an RF electrode;

a ~~conductive~~ lower ring made of an electrically conductive material;

a ceramic intermediate ring, the intermediate ring overlying the lower ring, the intermediate ring adapted to be attached via the lower ring to [[an]] the RF electrode, wherein the lower ring is in direct contact with the RF electrode; and

an upper ring adapted to surround the substrate, the upper ring overlying the intermediate ring, wherein the upper ring has an upper surface exposed to an interior of ~~a plasma reaction~~ the processing chamber.

17. (Original) The apparatus of claim 16, wherein the upper ring is bonded to the intermediate ring by a thermally conductive elastomer.

18. (Original) The apparatus of claim 16, wherein the lower ring is made of aluminum or alloy thereof.

19. (Original) The apparatus of claim 16, wherein the intermediate ring is made of aluminum oxide.

20. (Original) The apparatus of claim 16, wherein the upper ring is made from a material selected from the group consisting of quartz, silicon, silicon carbide, graphite and aluminum.

21. (Original) The apparatus of claim 16, wherein the plasma chamber is a semiconductor plasma etching apparatus.

22. (Previously Presented) The apparatus of claim 16, further comprising a quartz outer ring surrounding the upper ring.

23. (Previously Presented) A method of reducing process drift on a plurality of substrates in a plasma processing system comprising: positioning a substrate in the plasma processing apparatus of Claim 16; supplying process gas to the chamber; forming a plasma

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adjacent the upper surface of the substrate support; and sequentially processing a plurality of substrates in the plasma processing apparatus, wherein the temperature of the upper ring is substantially cooled to an initial temperature after a first substrate is removed from the substrate support and before a subsequent substrate is placed on the substrate support to reduce process drift.

24. (Original) The method of claim 23, wherein the substrate comprises a semiconductor wafer and the processing step comprises etching the semiconductor wafer with the plasma.

25. (Original) The apparatus of claim 16, wherein the lower ring is made of aluminum, aluminum alloy, brass, copper, copper alloy or stainless steel.

Allowable Subject Matter

2. Claims 1-25 are allowed.

3. The following is an examiner's statement of reasons for allowance: The prior art of record fails to teach or fairly suggest a temperature controlled hot edge ring assembly adapted to surround a semiconductor substrate support in a plasma reaction chamber wherein the ring assembly comprises a lower ring made of an electrically conductive material, a ceramic intermediate ring overlying the lower ring, and an upper ring overlying the intermediate ring, wherein the lower ring is in direct contact with the RF electrode as recited in independent claims 1 and 16.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

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fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sylvia R. MacArthur whose telephone number is 571-272-1438.

The examiner can normally be reached on M-F during the hours of 8:30 a.m. and 5 p.m.

5. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Sylvia R MacArthur
Patent Examiner
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March 20, 2007